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research division

To Mr. R.W. Patterson
Manager
Chemistry and Metallurgy Department
Central Thermal Services

Attn: Mr. T.E. Bond

INVESTIGATION OF SETTLEMENT BENEATH COAL STORAGE SITE - ATIKOKAN GS

H.T. Chan

A subsoil investigation was undertaken at the proposed coal storage area at the Atikokan TGS to determine the extent and physical properties of the organic soil layer existing beneath the rockfill. A total of four borings were made at the site to define the soil stratigraphy and to recover soil samples for laboratory tests. Based on the information collected by previous investigators at or near the proposed coal storage area and the present laboratory consolidation test data, the anticipated amount of settlement under the coal pile has been estimated.

INTRODUCTION

At the request of Mr. T.E. Bond of the Chemistry and Metallurgy Department of the CTS, a soil investigation was carried out at the proposed coal storage area at the Atikokan TGS in September 1984. The purpose of the investigation was to determine the subsoil conditions at the test site and, on the basis of the field and laboratory test results, to estimate the amount of anticipated settlement under the coal pile.

The report describes the field testing program, laboratory tests on the soil samples and presents the results of the settlement calculations.

SITE INVESTIGATION

A total of four boreholes were augered at the proposed coal storage area at Atikokan TGS (Figure 1). A backhoe was first used to excavate through the existing rockfill to the upper surface of the organic soil

layer. According to investigations carried out by Ontario Hydro staff/1,2,3/, the upper surface of the organic soil layer was the original ground surface at the test site. The excavations made by the backhoe were immediately filled with sand to prevent the caving in of the rockfill material into the pits. Subsequently a power augering machine was used to penetrate the sand fill and to continue the boring into the underlying soil layers. It was found that a layer of organic soil, the average thickness being 1.7 m, existed below the rock fill. A layer of silt (slightly cohesive) was found below the organic material.

Figures 2 to 5 show the soil stratigraphy found in the four boreholes. The results of the field vane tests are also presented. A number of soil samples were recovered from the boreholes for laboratory tests.

LABORATORY TESTING PROGRAM

The testing program consisted of the following parts:

(a) Examination of the soil samples recovered from the boreholes

- Rockfill material is made up of a mixture of sand, gravel cobbles and boulders
- Organic soil is a soft, wet fibrous material. Immediately beneath the rock fill, the organic soil contains fragments of wood and roots.
- The silt is slightly cohesive and contains a small quantity of sand.

(b) Particle size analysis

- A hydrometer test was performed on a silt sample. The particle size distribution of the silt is shown in Figure 6.

(c) Consolidation tests

- Consolidation tests were performed on two organic soil samples to determine the consolidation (settlement) characteristics of the very compressible material.

(d) Water content, bulk density, and unconfined compression tests were performed on representative samples. Results are summarized in Figures 2 to 5.

ESTIMATES OF SETTLEMENT

The most compressible soil layer under the coal pile is the organic soil beneath the rockfill material. Two consolidation tests were performed on this organic soil to measure the compressibility of the material. The test results are shown in Figures 7 and 8.

In the estimation of the settlement of the organic soil under the coal pile, a number of assumptions were made:

(i) the average thickness of the existing rockfill = 4.27 m (14 ft)
(ii) the bulk density of the rock fill = 2082 kg/m^3 (130 lbs/ft^3)
(iii) the average thickness of the organic soil = 1.7 m (5.6 ft)
(iv) the bulk density of the coal = 1200 kg/m^3 (75 lbs/ft^3)

The settlement in the organic soil was estimated according to the load imposed by the coal pile (Figure 9). For example, if the height of a coal pile is 12 m, the estimated settlement would be about 0.4 m (1.3 ft). Based on the measured rate in the laboratory consolidation tests, it was also estimated that 90% of the field settlement in the organic soil would occur in about 2 weeks.

In Figure 10 laboratory consolidation test data on the organic soil obtained by Radhakrishna/1/ are presented. The location of Borehole D-57 with respect to the proposed coal storage area can be found in Figure A1 in the Appendix.

In 1980, a test rockfill was placed near Borehole D-50 (see Figure A1) by Acres Shawinigan Limited to determine the amount of settlement of the organic soil under load/4/. The fill covered an area approximately 12.5 m wide by 35.0 m long. The total thickness of the fill varied from about 2.2 m at the north end to 5 m at the south end. The field experiment revealed that the total settlements were 1.6 m (north end) and 2.5 m (south end) for the fill height of 2.2 m and 5.0 m respectively. Because the soil conditions in Borehole D-57 (soil sample location) and Borehole D-50 (test fill location) were similar, the amount of settlement in the organic soil layer under the test fill was calculated using the laboratory data in Figure 10.

The computed settlement was found to be 2.4 m as compared to the measured 2.5 m. This favourable comparison of the calculated and experimental field results would indicate that the laboratory test data would give a reasonable estimate of the anticipated settlement in the organic soil at the proposed coal storage area.

It is understood that readings are being obtained from settlement gauges installed near the proposed coal storage area/5/. Unfortunately, the settlement gauges were installed after an unknown amount of settlement had already occurred in the organic soil under the weight of the rockfill. Therefore, these field settlement data were not used for the estimation of the settlement in the organic soil to be induced by the weight of the coal pile.

It is anticipated that the settlement under the coal pile will occur mainly in the organic soil layer. However, a small amount of settlement (eg 1 to 2 cm) may also occur in the rockfill and in the silt layer below the organic soil.

Because the height of the coal pile would vary depending on the consumption of the coal at the TGS, it would be difficult to estimate the settlement in the underlying soils due to the varying loading conditions. Settlement gauges installed at the base of the coal pile would give factual settlement data. If requested, the field instrumentation and monitoring program can be done by the Civil Research Department before the coal is placed.

COAL PILE STABILITY

In 1978, a preliminary study of coal pile stability at the proposed AtikokanTGS coal storage area was carried out by Huang/6/. The assumptions made in the analysis were presented in Figure 11. The calculated factor of the safety was 1.63 on the basis of the "circular arc" analysis. In Huang's study, it was assumed that the undrained strength (Cu) of the organic soil was equal to 14.4 kPa and the strength of the silt and clay layer was 27.8 kPa. According to the results of this present investigation, the Cu of the organic soil was larger than 14.4 kPa and the silt layer underlying the organic material should have a ϕ' value of at least 30°. Therefore, it can be concluded that if the proposed coal pile is 12 m high and has a 4 (horizontal):1 (vertical) side slope as shown in Figure 11, the factor of safety of the coal pile located at the 1984 proposed coal storage area should be larger than 1.63 (ie coal pile stable).

SUMMARY

An investigation of the soil conditions at the proposed coal storage area at the Atikokan TGS has been carried out by the Soils Section of the Civil Research Department. Based on the soil data obtained, the computed settlement in the organic soil under a coal pile of 12 m height would be about 0.4 m. Also, a 12 m high coal pile with a side slope of 4:1 should be stable at the proposed storage area.

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HTC:LM

REFERENCES

1. H.S. Radhakrishna. "Atikokan GS - Coal Storage and Ash Disposal Areas - In Situ and Laboratory Test Results". Ontario Hydro Research Division Report No 78-55-K, February 4, 1978.

2. A. Cohen. "Atikokan GS 1976 Field Investigation and Geotechnical Evaluation". Geotechnical Engineering Department Report No 76288, Dec 1976.

3. J. Grass and J.H.S. Huang. "Atikokan GS 1977 - Field Investigation and Geotechnical Evaluation". Geotechnical Engineering Department Report No 78013, February 1978.

4. Acres Shawinigan Ltd. "Site Finished Grading Volume 2 - Geotechnical Data". January 1983, p 9-3.

5. R. McIsaac. Atikokan GS - private communication.

6. H.S. Huang. "Atikokan GS Preliminary Study of Coal Pile Stability". Geotechnical Engineering Department Report No 78055, April 1978.

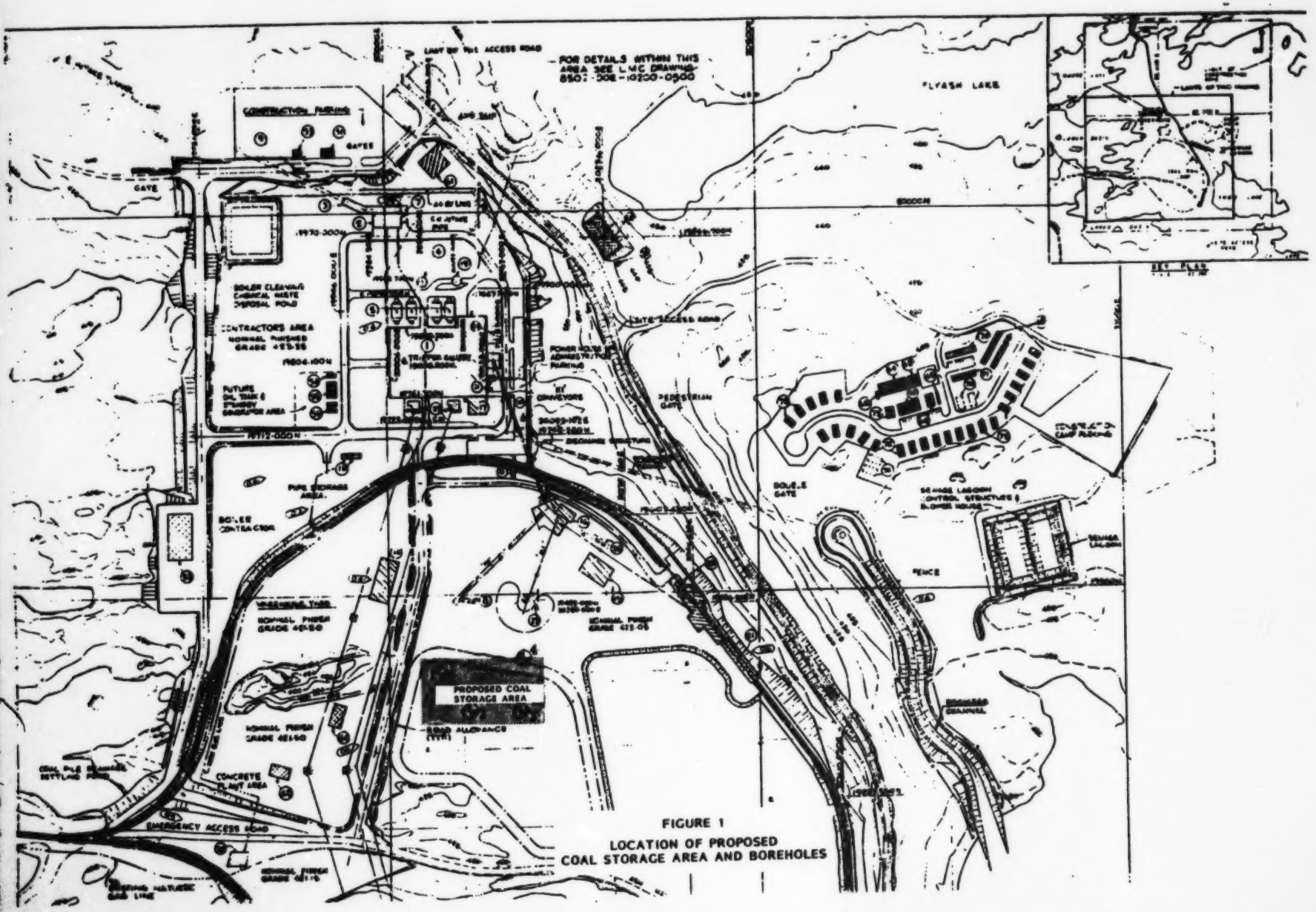


FIGURE 1
LOCATION OF PROPOSED
COAL STORAGE AREA AND BOREHOLES

200339-RD

PROJECT ATIKOKAN G.S. | HOLE TYPE AUGER | OBSERVER PA

LOCATION COAL STORAGE AREA | HOLE SIZE 6" HOLLOW STEM | COMPILED PA

DIP | DRILLED SEPTEMBER 12/89 | CHECKED

DATUM GROUND | BEARING | DRAWN PA | APPROVED

BORING DATA					BORING LOG	WATER INF.		FIELD TESTS		LABORATORY TESTS					
SCALE - METRES	ELEV / DEPTH	(1) SAMPLE NO	(2) SAMPLE TYPE	(3) 'N' VALUE per 0.3m / RQD - %	(4) WATER LEVEL and DATE	(5) DESCRIPTION / REMARKS	(6)	(7) OBSERVATION WELL DATA	(8) 'k' cm/s / WATER PRESS. TEST	(9) SPECIAL TESTS TYPE	(9) SPECIAL TESTS RESULTS	NATURAL DENSITY kg/m³	MOISTURE CONTENT - %	(10) SHEAR STRENGTH kPa TYPE	(10) SHEAR STRENGTH kPa RESULTS	(11) SPECIAL TESTS TYPE	(11) SPECIAL TESTS RESULTS
	122.81					GROUND											
1	0.00					SAND, GRAVEL, COBBLES, AND BOULDERS (FILL)											
2																	
3																	
4	118.34				▽												
5	4.27					VERY LOOSE, WET, BLACK FIBROUS ORGANIC MATTER											
	117.32	1		PUSH													
6	5.49	2		PUSH		COMPACT, MOIST, GREY SILT (SLIGHTLY COHESIVE) WITH A LITTLE FINE SAND				VANE	S-116 R-50 kPa	2090	17.9	w_L	134		
7																	
8		3	☒	PUSH								1980	24.2	w_L	71		
9																	
10		4	☒	14									25.9				
													18.5				
11	111.68	5	☒	19													
12	11.13					END OF HOLE											

GEOTECHNICAL DATA SHEET

hole no BH-1 | Fig 2

drawn 200353 RD

PROJECT ATIKOKAN G.S. HOLE TYPE AUGER OBSERVER PA

LOCATION COAL STORAGE AREA HOLE SIZE 6" HOLLOW STEM COMPILED PA

DIP DRILLED SEPTEMBER 12/84 CHECKED

DATUM GROUND BEARING DRAWN PA APPROVED

BORING DATA						BORING LOG		WATER INF.		FIELD TESTS		LABORATORY TESTS					
SCALE - METRES	ELEV / DEPTH	(1) SAMPLE NO	(2) SAMPLE TYPE	(3) 'N' VALUE per 0.3m / RQD-%	(4) WATER LEVEL and CASING	(5) DESCRIPTION	(6) REMARKS	(7) OBSERVATION WELL DATA	(8) 'k' cm/s	(9) SPECIAL TESTS TYPE	(9) SPECIAL TESTS RESULTS	NATURAL DENSITY kg/m³	MOISTURE CONTENT - %	(10) SHEAR STRENGTH kPa TYPE	(10) SHEAR STRENGTH kPa RESULTS	(11) SPECIAL TESTS TYPE	(11) SPECIAL TESTS RESULTS
	822.98					GROUND			WATER PRESS. TEST								
	6.09				W.R.	SAND, GRAVEL, COBBLES, AND BOULDERS (FILL)											
	816.41																
	4.57	1		PUSH		VERY LOOSE, WET, BLACK FIBROUS ORGANIC MATTER				VANE	S-62 R-29 kPa						
	816.72	2		PUSH													
	6.25	3		36		COMPACT, MOIST GREY SILT (SLIGHTLY COHESIVE) WITH A LITTLE FINE SAND							17.0				
	815.36																
	7.62					END OF HOLE	REFUSAL ON BOULDER OR BEDROCK										

GEOTECHNICAL DATA SHEET

HOLE NO BH-2 Fig 3

DRAWING 200352 RD

PROJECT. ATIKOKAN G.S. HOLE TYPE. AUGER OBSERVER PA

LOCATION. COAL STORAGE AREA HOLE SIZE 6" HOLLOW STEM COMPILED PA

DIP. DRILLED. SEPTEMBER 13/84 CHECKED.

DATUM GROUND BEARING DRAWN. PA APPROVED

SCALE - METRES	ELEV / DEPTH	(1) SAMPLE NO	(2) SAMPLE TYPE	(3) 'N' VALUE per 0.3m / RQD - %	(4) WATER LEVEL (and Casing) / W.R.	(5) BORING LOG — DESCRIPTION	(6) REMARKS	WATER INF. (7) OBSERVATION WELL DATA	(8) 'k' cm/s	FIELD TESTS (9) SPECIAL TESTS TYPE	RESULTS	WATER PRESS. TEST	LABORATORY TESTS: NATURAL DENSITY kg/m³	MOISTURE CONTENT - %	(10) SHEAR STRENGTH kPa TYPE	RESULTS	(11) SPECIAL TESTS TYPE	RESULTS
	322.97 GROUND																	
1	8.00				▽	SAND, GRAVEL, COBBLES AND BOULDERS (FILL)												
	318.10	1		PUSH										21.8				
	8.87	2		PUSH		VERY LOOSE, WET, BLACK FIBROUS ORGANIC MATTER				VANE	S-119 R-55 kPa							
	316.86	3		PUSH									969 1019	381.6 337				
7	6.86	4		20		COMPACT GREY, MOIST SILT (SLIGHTLY COHESIVE) WITH A LITTLE FINE SAND								22.2				
		5		27										20.5				
11		6		19										22.7				
12		7		17										11.9				
13	310.21 12.65					END OF HOLE												

GEOTECHNICAL DATA SHEET

Hole no BH 3 Fig 4

Sheet 200351 RD

PROJECT . ATIKOKAN G.S. . . . . HOLE TYPE. AUGER . . . . . OBSERVER . PA . . . . .

LOCATION . COAL STORAGE AREA . . . . . HOLE SIZE 6" HOLLOW STEM . COMPILED . PA . . . . .

. . . . . DIP . . . . . DRILLED . SEPTEMBER 13/84 . . CHECKED . . . . . .

DATUM . . . . GROUND . . . . . BEARING . . . . . DRAWN . . . . PA . . . . . APPROVED . . . . . .

BORING DATA						BORING LOG	WATER INF.		FIELD TESTS		LABORATORY TESTS				
SCALE - METRES	ELEV / DEPTH	(12) SAMPLE NO	(11) SAMPLE TYPE	(13) 'N' VALUE or R.Q.D. - %	(14) WATER LEVEL and CAVING W.L.	(15) DESCRIPTION / (16) REMARKS	(17) OBSERVATION WELL DATA	(18) 'k' mm/sec cm/s WATER PRESS TEST	(19) SPECIAL TESTS TYPE	RESULTS	NATURAL DENSITY kg/m³	MOISTURE - % CONTENT	(20) SHEAR STRENGTH kPa TYPE	RESULTS	(21) SPECIAL TESTS TYPE	RESULTS
	322.69					GROUND									
1	0.00					SAND, GRAVEL, COBBLES AND BOULDERS (FILL)									
2															
3															
4															
5	318.12				W.L.										
	4.57	1	⊠	9		VERY LOOSE, WET, BLACK FIBROUS ORGANIC MATTER			VANE	S-74 K-29 kPa		383			
6	315.29	2	■	PUSH								187			
	7.40					COMPACT, MOIST, GREY SILT (SLIGHTLY COHESIVE) WITH A LITTLE FINE SAND						18.7			
7															
8		3	⊠	26								21.4			
9															
10		4	⊠	32								26.8			
11		5	⊠	25								26.2			
12	310.09	6	⊠	24								26.8			
13	12.69					END OF HOLE									

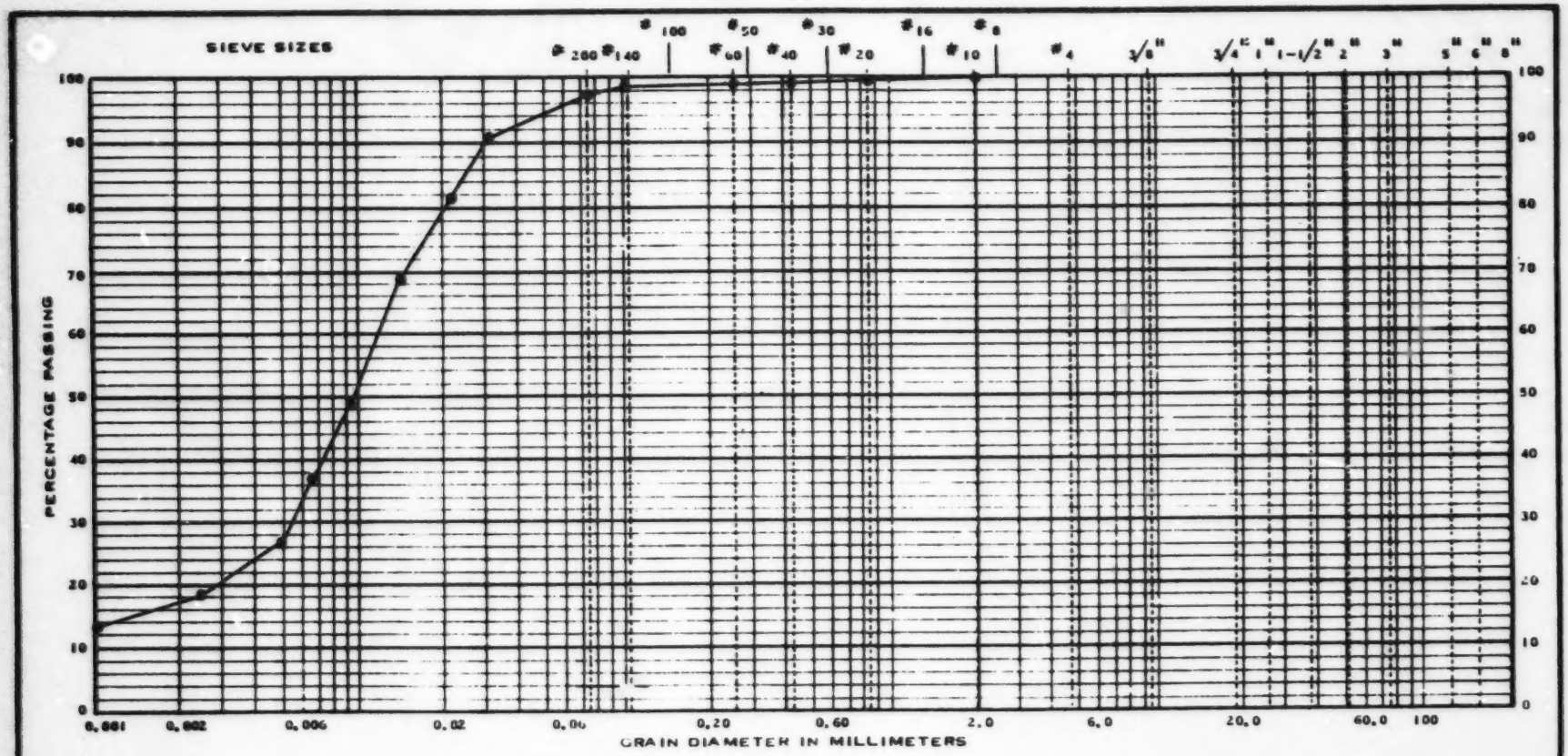
GEOTECHNICAL DATA SHEET

BH 4

Fig 3

200350 RD

MECHANICAL ANALYSIS



CLAY	TO SILT	SAND			GRAVEL		COBBLES
		FINE	MEDIUM	COARSE	FINE	COARSE	

UNIFIED SOIL CLASSIFICATION

ATIKOKAN COAL STORAGE AREA
BH-1, S-3
GREY SILT

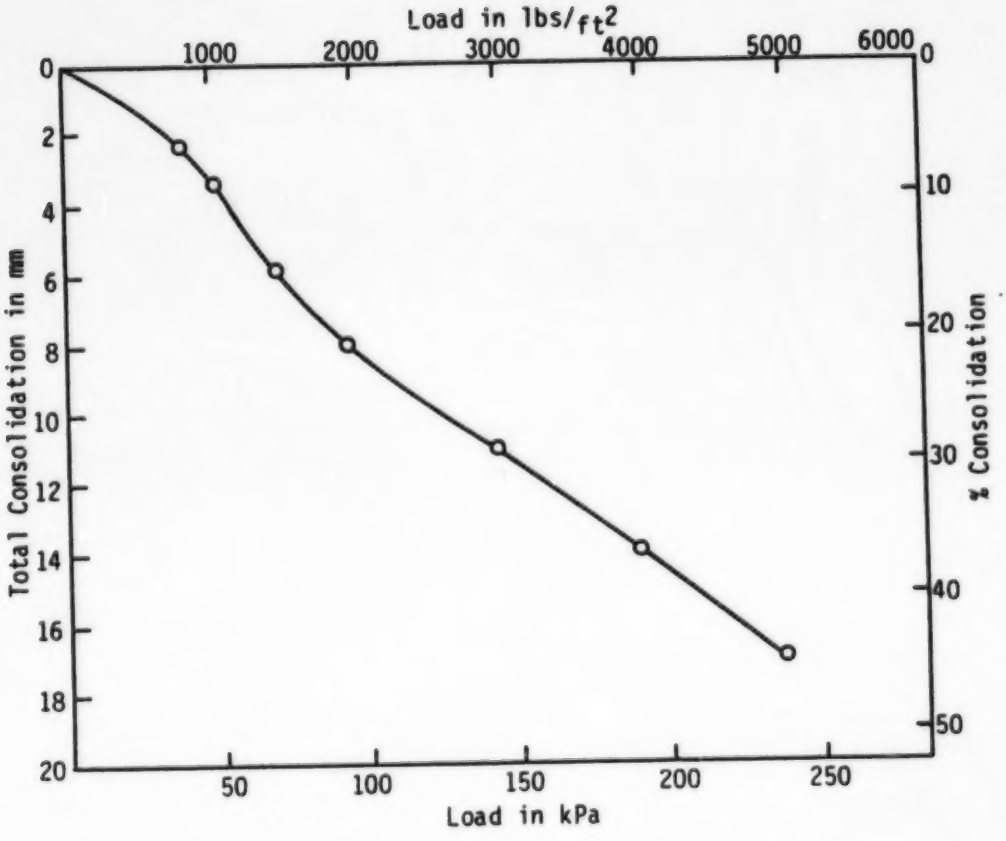
90992
new 80-11

Ontario Hydro

RESEARCH DIVISION

FIGURE 6

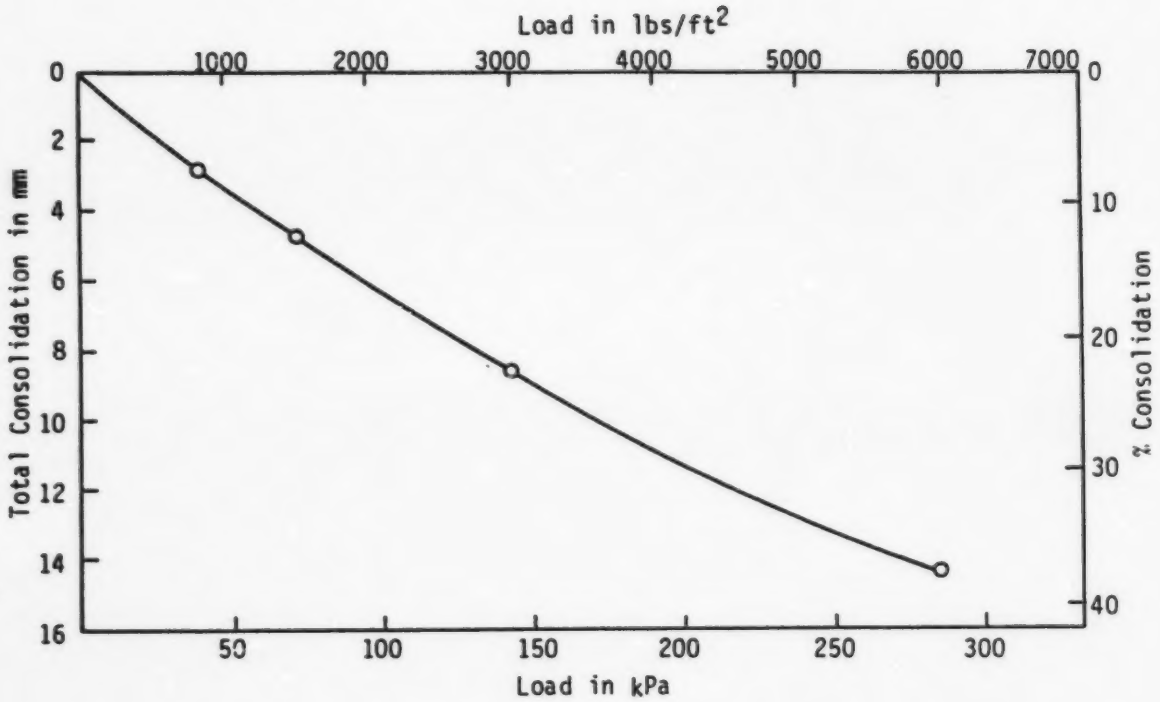
167357 RD



Specimen	Before Test	After Test
Weight (g)	41.82	34.71
Volume (cm^3)	43.15	27.01
Water Content (%)	382.0	291.0
Height (cm)	3.810	2.385

FIGURE 7

CONSOLIDATION TEST NO.1, SPECIMEN FROM BH-3, S-3 (BLACK FIBROUS ORGANIC SOIL)



Specimen	Before Test	After Test
Weight (g)	43.96	35.48
Volume (cm^3)	43.15	26.89
Water Content(%)	337.0	296.9
Height (cm)	3.810	2.374

FIGURE 8

CONSOLIDATION TEST NO.2, SPECIMEN FROM BH-3, S-3
(BLACK FIBROUS ORGANIC SOIL)

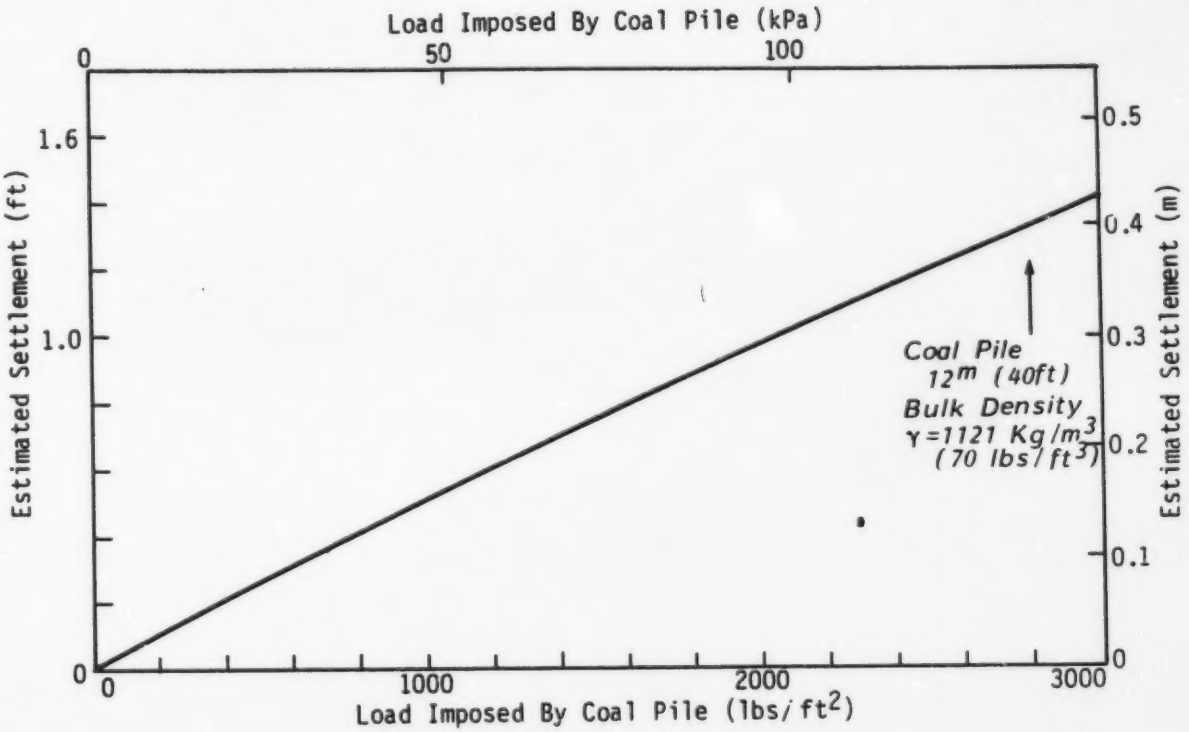


FIGURE 9

ESTIMATED SETTLEMENT IN ORGANIC SOIL
CAUSED BY COAL PILE LOAD

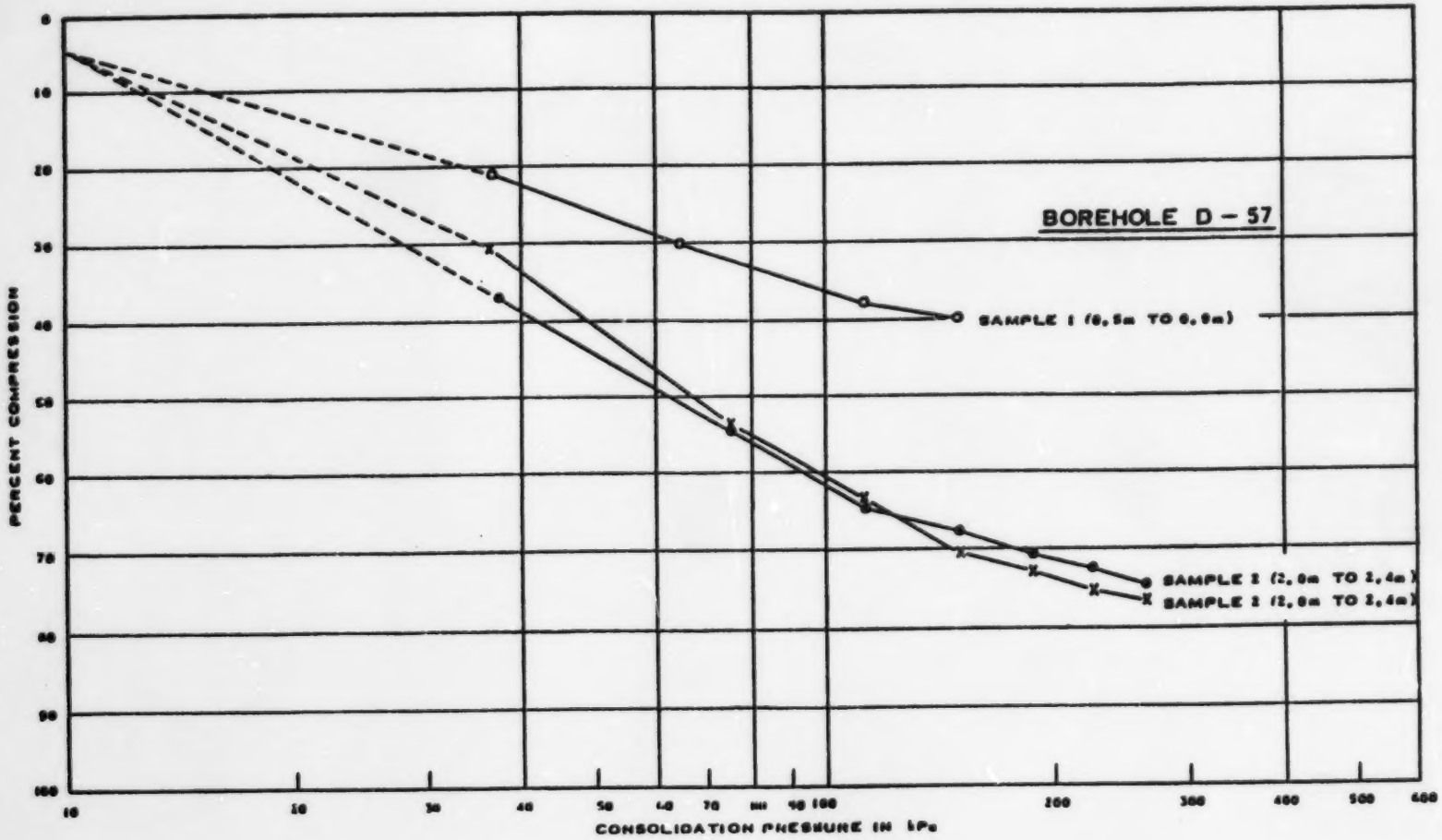

BOREHOLE D – 57
SAMPLE 1 (0.5m TO 0.9m)
SAMPLE 2 (2.0m TO 2.4m)
SAMPLE 3 (2.0m TO 2.4m)
PERCENT COMPRESSION
CONSOLIDATION PRESSURE IN kPa

FIGURE 10

PERCENT COMPRESSION VS LOG PRESSURE CONSOLIDATION TEST
ON PEAT SAMPLE FROM COAL STORAGE AREA

Reference: H.S. Radhakrishna "Atikokan G.S.-Coal Storage and Ash Disposal Areas" Ontario Hydro Research Div., Report No. 78-55-K, Fig 14
Note: Borehole D-57 in the 1978 soil investigation was near the present proposed coal storage area.

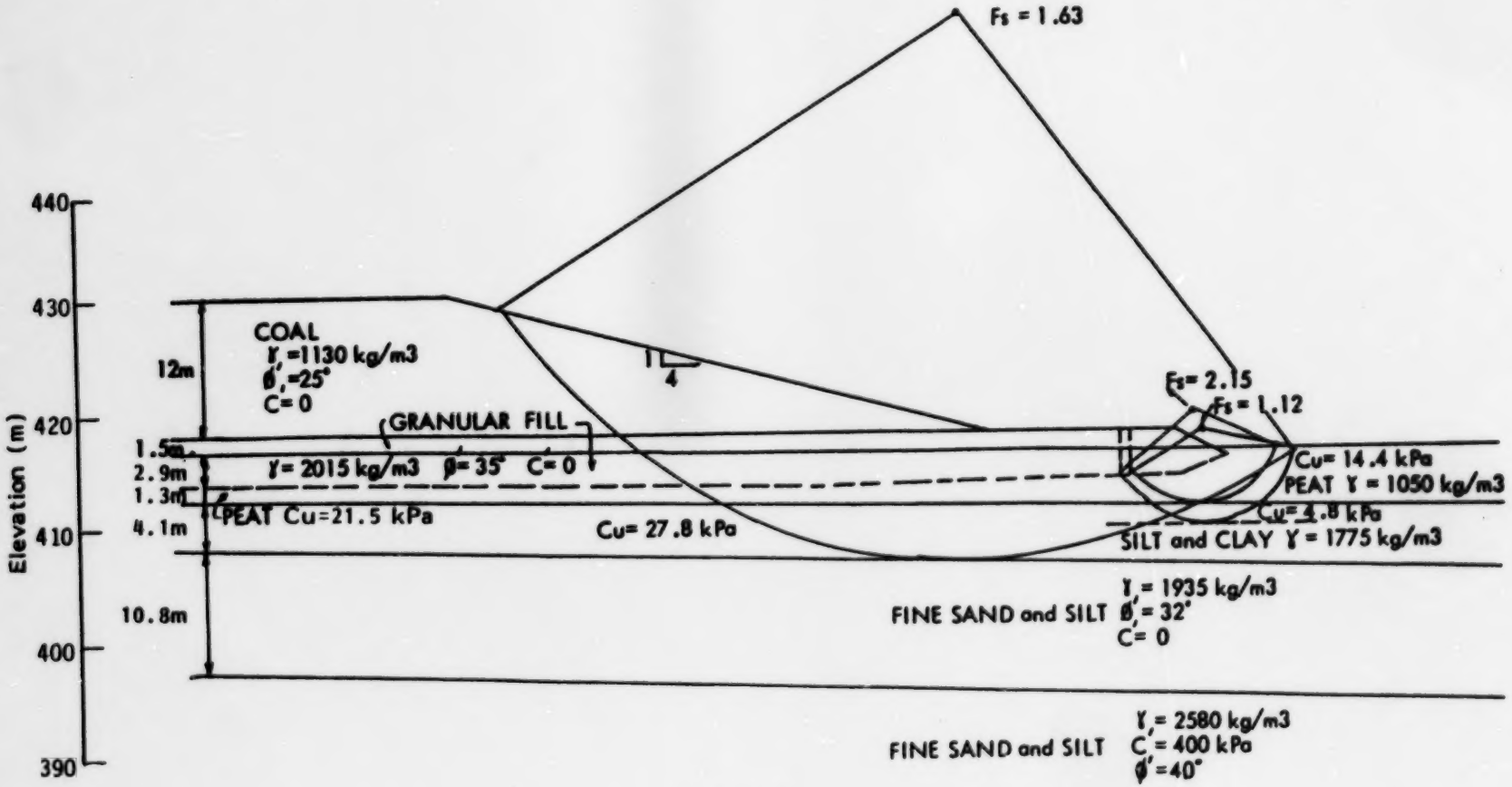


FIGURE 11

COAL PILE STABILITY ANALYSIS BY BISHOP'S METHOD

Reference: H.S. Huang "Atikokan G.S. Preliminary Study of Coal Pile Stability" Geotechnical Engineering Department, Report No. 78055, Figure 11

167355 RD

APPENDIX

(1) Figure A1 - Location of Boreholes in the 1976 and 1977 Atikokan GS Field Investigations/2,3/

(2) Borehole logs obtained on the 1976 and 1977 investigations

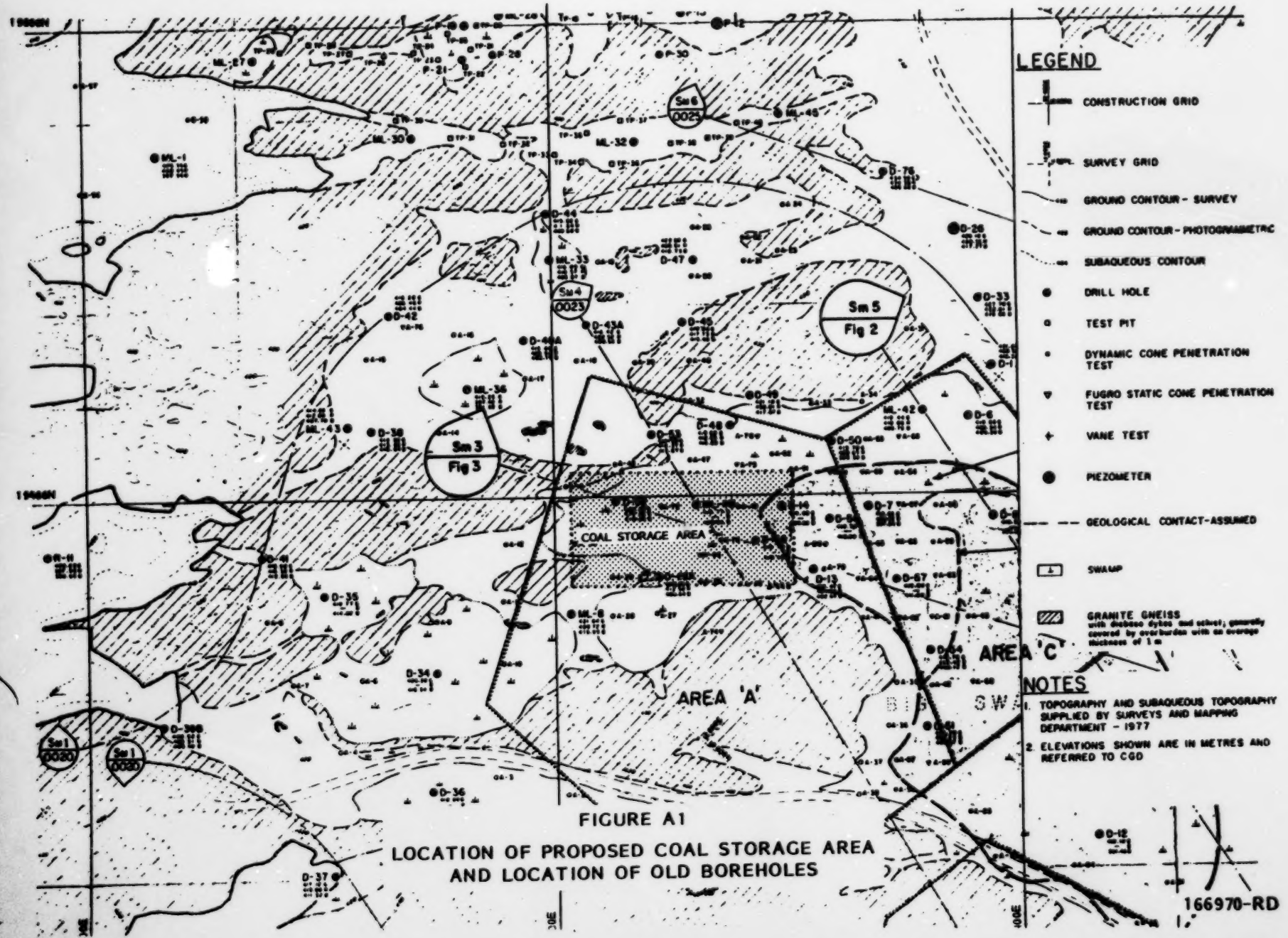


FIGURE A1

LOCATION OF PROPOSED COAL STORAGE AREA AND LOCATION OF OLD BOREHOLES

GEOTECHNICAL DATA SHEET HOLE NO. D-13 SHEET 1 OF 1

PROJECT ATIKOKAN G.S. SITE C.W. DISCHARGE AREA HOLE TYPE ROTARY DIAMOND COMPILED MH

LOCATION 35,340N 41,920E DIP 90° HOLE SIZE AX CHECKED

DATUM CALAND ORE CO. DATUM BEARING — STARTED 11 AUG 76 APPROVED

FINISHED 24 AUG 76

BORING LOG				SAMPLES			FIELD TESTS	WATER INFORMATION			
SCALE - FEET	ELEVATION - FEET	STRATIGRAPHIC PLOT	DESCRIPTION	NUMBER	TYPE	BLOWS PER FOOT	SAMPLER ○ CONE ▱ STD. PENETRATION TEST (BLOWS PER FOOT)	DRILLING WATER RETURN	WATER PRESSURE TESTS	WATER LEVEL OBSERVATION	REMARKS
	1277.7 DATUM		GROUND						POUR TESTS		
	1276.8 0.9		WET, LOOSE, BROWN ORGANICS	1	SS	3					NOTE (1) POUR TEST BASED ON CONSTANT HEAD
				2	SS	4	5/12				VANE TEST NO. 10 VANE (37.0) P = 331 PSF R = 138 PSF
	13.3'		WET, LOOSE, GREY, VERY FINE TO FINE SAND, WITH SILT	3	SS	7					VANE TEST NO. 10 VANE (37.0) P = 588 PSF R = 192 PSF
	16.3'		WET, SOFT, GREY CLAY, WITH SILT-LAYERED	4	SS	12					VANE TEST NO. 10 VANE (37.0 P = 2,484 PSF
	26.3'		WET, COMPACT, GREY, FINE SAND, WITH SILT	5	SS	11					
	37.3'		WET, COMPACT, GREY SILT, WITH FINE SAND - LAYERED	6	SS	9					VANE TEST NO. 10 VANE (37.0) P = 1,104 PSF R = 414 PSF
	48.3'		WET, LOOSE TO COMPACT, GREY, FINE SAND, LITTLE SILT	7	SS	10					
	1229.0 48.7'		PRECAMBRIAN GRANITE GNEISS LIGHT GREY - GREEN, HARD, DENSE, FINE TO MEDIUM GRAINED	8	SS	11					
				9	SS	5					
	1227.5 50.3		END OF HOLE CR 90%					100%			CC GOOD TO VERY GOOD
											HOLE GRAVITY GROUTED 1/1 BAG CEMENT

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geotechnical department

166964-RD

GEOTECHNICAL DATA SHEET HOLE NO. D-14 SHEET 1 OF 1

PROJECT ATIKOKAN G.S. SITE CW DISCHARGE AREA HOLE TYPE ROTARY DIAMOND COMPILED MH

LOCATION 35,420N 41,740E DIP 90° HOLE SIZE NW CHECKED

DATUM CALAND ORE CO. DATUM BEARING — STARTED 24 AUG 76 APPROVED

FINISHED 25 AUG 76

BORING LOG				SAMPLES			FIELD TESTS	WATER INFORMATION			REMARKS
SCALE - FEET	ELEVATION - FEET	STRATIGRAPHIC PLOT	DESCRIPTION	NUMBER	TYPE	BLOWS PER FOOT	SAMPLER ○ CONE ▭ STD. PENETRATION TEST N, BLOWS PER FOOT 50 100	DRILLING WATER RETURN	WATER PRESSURE TESTS	WATER LEVEL OBSERVATION	
	1337.9 DATUM		GROUND						POUR TESTS		
0	0.0'		WET, LOOSE, BLACK ORGANICS	1	P	–					NOTE (a) POUR TEST BASED ON CONSTANT HEAD
10	10.0'		MOIST, COMPACT, GREY SILT, SOME CLAY, TRACE FINE TO MEDIUM SAND - LAYERED	2	AT	16					
				3	AT	20					
20	20.0'		WET, COMPACT, GREY, FINE SAND, WITH SILT - LAYERED	4	AT	16					
				5	AT	18					
30	30.0'		WET, COMPACT, GREY SILT, WITH FINE TO COARSE SAND, SOME FINE GRAVEL	6	AT	20					
	34.0'		WET, COMPACT, GREY, FINE SAND	7	AT	18					
40	40.0'		WET, DENSE, GREY, FINE TO MEDIUM SAND, SOME FINE TO COARSE GRAVEL, TRACE SILT	8	AT	37					
	1329.9		END OF HOLE								
	48.0'										
50											
60											

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166965-RD

GEOTECHNICAL DATA SHEET

HOLE NO. D-46A SHEET 1 OF 1

PROJECT ATIKOKAN GS SITE COAL PILE AREA HOLE TYPE ROTARY DIAMOND COMPILED MH

LOCATION 10 680.00 N, 12 680.00 E (METRIC SURVEY) HOLE SIZE AX CHECKED PSH

DIP 90° STARTED 28 JUL 77 APPROVED

DATUM CGD (METRIC) BEARING — FINISHED 4 AUG 77

BORING LOG				SAMPLES			FIELD TESTS	WATER INFORMATION			
SCALE - METRES	ELEV. / DEPTH	STRATIGRAPHIC PLOT	DESCRIPTION	NUMBER	TYPE	BLOWS PER 0.3m	SAMPLER ○ CONE ⇀ STD PENETRATION TEST (BLOWS PER 0.3m) 50 100 150 RQD 25 50 75	DRILLING WATER RETURN	WATER PRESSURE TESTS	WATER LEVEL OBSERVATION	REMARKS
			481.30 DATUM								
1	480.20 / 1.10		GROUND								
	1.40		VERY LOOSE, WET, BLACK, FIBROUS ORGANIC MATTER	1	AS	3					
2			COMPACT, WET, DARK GREY SILT, SOME FINE SAND								
3				2	A	21					D-46
4	3.00										
5			NO SAMPLE RECOVERY MATERIAL IS PROBABLY PERVIOUS SAND, GRAVEL, COBBLES, AND BOULDERS								
6											
7											
8	473.50 / 8.00										
9			GRANITE GNEISS GREY-GREEN, HARD, MEDIUM GRAINED, MODERATELY FRACTURED				100% 80%	100%			
10											
11								100%			
12									LI EYE		
13	468.31 / 12.79		END OF HOLE CR 100%								HOLE GRAVITY GROUTED

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GEOTECHNICAL DATA SHEET

HOLE NO. D-52 SHEET 1 OF 1

PROJECT ATIKOKAN GS SITE COAL STORAGE AREA HOLE TYPE AUGER COMPILED MH

LOCATION 10708.00N, 12611.00E (METRIC SURVEY) HOLE SIZE 6", AX CHECKED PJ

DIP 90° STARTED 11 AUG 77 APPROVED

DATUM C.G.D. (METRIC) BEARING — FINISHED 12 AUG 77

BORING LOG				SAMPLES		FIELD TESTS	WATER INFORMATION			
SCALE - METRES	ELEV. / DEPTH	STRATIGRAPHIC PLOT	DESCRIPTION	NUMBER	TYPE	BLOWS PER 0.3m	SAMPLER / CONE / STD PENETRATION TEST (BLOWS PER 0.3m) 50 100 150 / ROD 25 50 75	DRILLING WATER RETURN	WATER PRESSURE TESTS	WATER LEVEL OBSERVATION	REMARKS
	421.30 DATUM										
1	420.30 / 1.10		GROUND								
2			VERY LOOSE, WET, BROWN, FIBROUS ORGANIC MATTER	1	AS	1					
3	417.77			2	A	11					VANE TEST F = 93 kPa R = 82 kPa
4			LOOSE TO VERY DENSE, MOIST, GREY SILT, LITTLE VERY FINE SAND	3	A	35					
5											
6				4	A	17					
7											
8				5	A	57					
	413.16 / 8.00		NO SAMPLE RECOVERY PROBABLY SAND WITH GRAVEL								
		8.30	GRANITE GNEISS GREY-GREEN, HARD, DENSE, MEDIUM GRAINED, LIGHTLY FRACTURED					100%	—	0.3 / 207	
10	410.70 / 10.60		CHLORITE SCHIST DARK GREEN, HARD, DENSE, FINE GRAINED, SCHISTOSITY AT 15° TO CORE AXIS								
11			END OF HOLE CR 83%								HOLE GRAVITY GROUTED

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GEOTECHNICAL DATA SHEET

HOLE NO. **D-53** SHEET 1 OF 1

PROJECT ATIKOKAN GS SITE COAL STORAGE AREA HOLE TYPE ROTARY DIAMOND COMPILED MH

LOCATION 10772.00N, 12398.00E (METRIC SURVEY) DIP 90° HOLE SIZE AX CHECKED RJ

BEARING — STARTED 12 AUG 77 APPROVED RJ

DATUM C.G.D. (METRIC) FINISHED 16 AUG 77

BORING LOG				SAMPLES		FIELD TESTS	WATER INFORMATION			
SCALE - METRES	ELEV / DEPTH	STRATIGRAPHIC PLOT	DESCRIPTION	NUMBER	TYPE / BLOWS PER 0.3m	SAMPLER CONE; STD PENETRATION TEST (BLOWS PER 0.3m); RQD	DRILLING WATER RETURN	WATER PRESSURE TESTS	WATER LEVEL OBSERVATION	REMARKS
	419.99 DATUM									
1	419.99 / 0.00		GROUND							
	419.38 / 0.61		BLACK, WOODY ORGANIC MATTER	1	A 10					
2			COMPACT, MOIST, MOTTLED GREY BROWN SILT, WITH FINE SAND							
	417.48 / 2.51		COMPACT, WET, BROWN, VERY FINE SAND, SOME SILT (PERVIOUS)	2	A 22					
3										
4	416.28 / 3.71		COMPACT, WET, GREY, FINE TO COARSE SAND, LITTLE SILT (PERVIOUS)	3	A 13/0.04m					
	415.57 / 4.42									
5			CHLORITE SCHIST GREEN, HARD, DENSE, FINE GRAINED, MODERATELY FRACTURED				100%			
6							—			
7							NR	3.3 / 30T		
	412.87 / 7.12		END OF HOLE CR 100%							HOLE GRAVITY GROUTED

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GEOTECHNICAL DATA SHEET

HOLE NO. D-55 SHEET ..1.. OF ..1..

PROJECT ATIKOKAN GS SITE COAL PILE AREA HOLE TYPE PRESSURE METER COMPILED MH

LOCATION 10759.00N, 12725.00E (METRIC SURVEY) DIP 90° HOLE SIZE CHECKED RJH

DATUM CGD (METRIC) BEARING — STARTED 23 AUG 77 APPROVED RJH

FINISHED 24 AUG 77

BORING LOG				SAMPLES			FIELD TESTS	WATER INFORMATION			
SCALE - METRES	ELEV. / DEPTH	STRATIGRAPHIC PLOT	DESCRIPTION	NUMBER	TYPE	BLOWS PER 0.3m	SAMPLER ○ CONE ⏚ STD PENETRATION TEST (BLOWS PER 0.3m) 50 100 150	DRILLING WATER RETURN	WATER PRESSURE TESTS	WATER LEVEL OBSERVATION	REMARKS
	418.70		DATUM AND GROUND								
1 2 3			VERY LOOSE, WET, BLACK, WOODY, FIBROUS, COARSE TO FINE PEAT **ORGANIC** MATERIAL								
4	3.00		COMPACT, MOIST, GREY **SILT**, LITTLE MEDIUM SAND								
5	4.30		COMPACT, WET, GREY, LAYERED FINE **SAND**, SOME SILT, OCCASIONAL CLAY LENS								
6 7 8	4.55		COMPACT, WET, GREY, LAYERED **SILT**, SOME FINE SAND, LITTLE CLAY.								
9	418.50 / 8.20		END OF HOLE								

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